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STORM AND COMBINED SEWER POLLUTION CONTROL PROGRAM

Edison Water Quality Laboratory
Edison, New Jersey

September 1970

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PROGRESS REPORT

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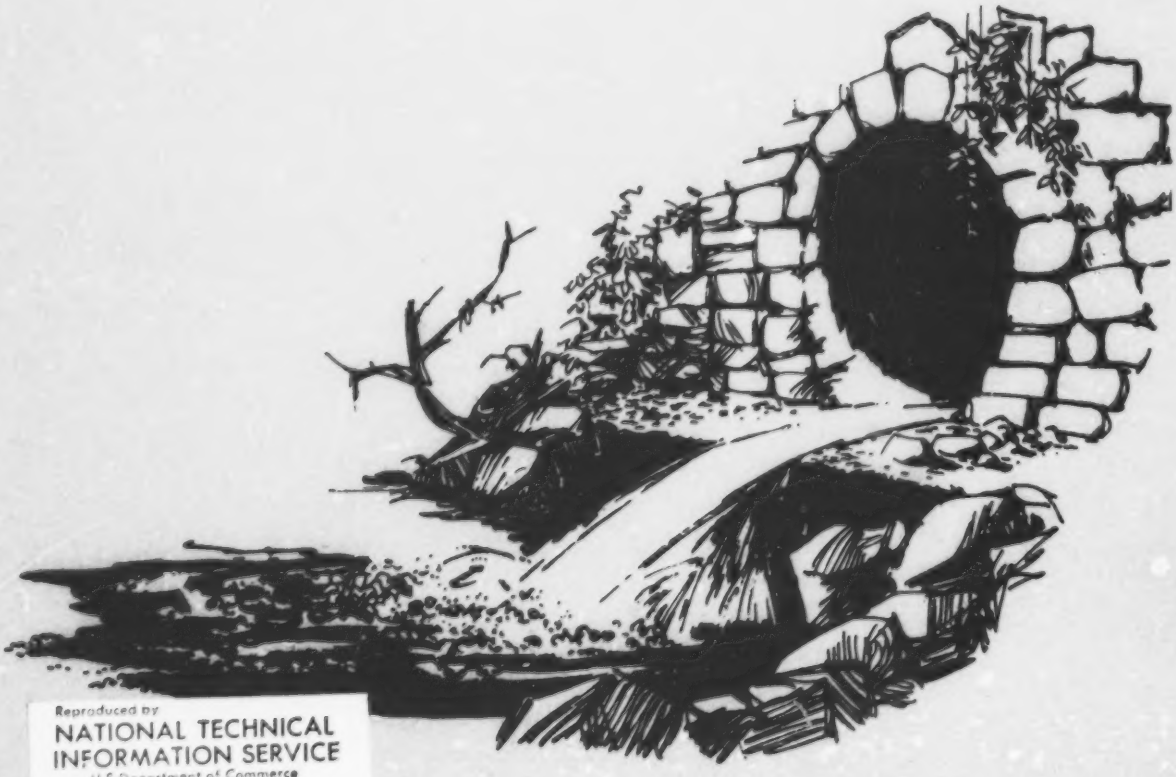

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WHO'S WHO IN STORM AND COMBINED SEWER POLLUTION R&D

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The Edison Water Quality Laboratory, Edison, New Jersey, has National R&D responsibilities in the respective areas of Storm and Combined Sewer Discharges; Oil Pollution and Hazardous Materials Spills; Watercraft Wastes; and Biological Identification of Pollutants. This annual state-of-the-art provides information on the Storm and Combined Sewer Pollution Control Program at Edison, N. J. and Washington, D. C. which falls into the three PPBS categories: 1102 - Combined Sewer Overflows; 1103 - Storm Water Discharges; and 1104 - Non-Sewered Runoff. The Edison activities up to the present time have consisted of technical support given to Headquarters, coordination and management of the Federally-financed extramural program, initiation of various State-of-the-Art reports, planning for in-house research, and special consultation when indicated. We hope there will be opportunity to expand the Edison program this Fiscal Year, particularly with respect to an in-house study of treatment processes for storm and combined sewer overflows.

PROGRAM BACKGROUND

Pollution resulting from combined sewer overflows and storm runoff was identified as a significant Nationwide problem by the FWQA (then the Public Health Service) early in 1964. A demonstration grant and contract program was authorized by the Water Quality Act of 1965, and this program was initiated in the FWQA in the Spring of 1966. One of the first FWQA contracts was given to the American Public Works Association. Under this study it was established that the cost of separating combined sewers, including plumbing changes, would amount to some $48 billion Nationwide. Use of alternative treatment and control measures could forseeably reduce this cost to $15-$20 billion. Considering rising construction costs, these respective figures for 1970 are now in excess of $70 billion and $20-$25 billion. The total area in the United States served by combined sewers is estimated around 3 million acres located within 1,330 governmental jurisdictions representing a total U. S. population around 54 million persons. Total length of sewerage systems is estimated to be 55,000 miles of combined sewers, 44,300 miles of sanitary sewers, and 17,000 miles of separate storm sewers.

PROBLEM DEFINITION

The problems of combined sewer overflows are severe through the Northeast, Mid-West and Northwest parts of the U. S.; these problems are present but in lesser degree over the remaining parts of the country. Sewered and non-sewered storm runoff prevails across the U. S. including Hawaii. As we approach closer to the goal of providing adequate treatment for normal, dry-weather sanitary sewage flows, other sources of water pollution including polluted storm flows, become increasingly obvious. There are numerous locations across the country where wet weather flows are a major cause of water quality degradation and water use impairment, particularly affecting

recreational uses. A partial list would include Boston, New York Harbor and Jamaica Bay, the Hudson River, Washington, D. C., Lake Erie around Cleveland and Buffalo, Lake Michigan at Chicago and Milwaukee, Mobile Bay, San Francisco Bay, New Orleans, Minneapolis, Detroit, and Philadelphia.

Combined sewers have inherent, "built-in" inadequacies and inefficiencies. Combined sewers are intended to convey both sanitary sewage and storm water but conduits are designed in many cases to carry only two or three times average dry weather flows. In certain cases, combined sewer overflows to the receiving stream may occur with 0.05 inches of rainfall or less. Other combined sewers may overflow every day of the week even under dry weather conditions. A combined system, of necessity, incorporates planned (and unplanned) overflow points to relieve the system of excess flows when runoff exceeds system design. These overflow points comprise diversion structures and flow regulators including hydraulically and manually-operated sluice gates, weirs, pumping stations, siphons, relief sewers, and very importantly, sewage treatment plant by-passes. A major objective of the Storm and Combined Sewer Pollution Control R&D Program is to develop and demonstrate means of correcting these system ineffieiencies in such a way that overflows can be controlled and/or treated with a dependable and sufficiently high level of performance. By these means, proper control and/or treatment methods can be substituted for sewer separation.

Urban storm runoff has likewise been shown to be a significant pollution source in addition to combined sewer overflows. In Bucyrus, Ohio, it has been recently shown that if sewer separation were used as the future abatement procedure, reduction of wet weather pollution would only be 50 percent, due to the polluting character of the remaining storm water.

IMPLEMENTATION

The Storm and Combined Sewer Pollution Control R&D Program has attempted to determine whether storm and combined sewer overflows are adequately recognized in the various State Water Quality Standards and Implementation Plans. In review of the State plans, it was found that 34 of 50 States intended to consider these problems in the future, when and if sufficient funds were available. However, only 17 States were judged to give minimum recognition to existing problems, and only 12 States were believed to have (at this time) adequate knowledge and capability for proceeding on action plans. Also, there was very little consideration given to pollution from storm runoff. Many States with large numbers of combined sewer systems were unfortunately, not included in the second or third categories above. The Storm and Combined Sewer Pollution Control Program recommends that future revisions of State Water Quality Standards should fully consider pollution caused by combined sewer overflows and storm water discharges,

and that requirements for control and/or treatment of these wastes should be contained in the revised standards. Furthermore, it is believed that pollution abatement priorities established by the States for implementing these Standards should include action to be taken on combined sewer overflows and storm water.

RECOGNITION OF COMBINED SEWER OVERFLOWS AND STORM FLOWS IN NEW CONSTRUCTION GRANTS

Under new rules and regulations governing issuance of Federal grants for construction of municipal treatment works (Title 18, Chapter V, Part 601 as contained in the Federal Register, July 2, 1970), it has been stipulated that in the future, grants shall be awarded on the basis of effective basin and metropolitan or regional plans for the abatement of water pollution. The purpose of these regulations is to give maximum assurance that this massive investment to which the Federal Government is committed will proceed in an orderly and coordinated fashion, and that these plans will achieve maximum protection and enhancement of water resources at a high level of cost effectiveness. The fully developed plans shall include identification of combined sewer overflows and storm water discharges, and this data is to be reported in terms of frequency-volume relationships. The basin and metropolitan or regional plans shall also consider the need for and the capability to deal with wastes from sewers which convey storm water or both storm water and sewage.

In regard to the above provisions, based upon past experience and research, the Storm and Combined Sewer Pollution Control Program proposes the current Federal policy should be modified to discourage sewer separation except under special circumstances. In lieu of sewer separation, it is proposed that total system control techniques and capabilities should be incorporated into a master plan for complete control of all waste sources within the affected jurisdiction. Storm water should also be interpreted to include both sewered and non-sewered runoff.

RESULTS OF RESEARCH, DEVELOPMENT AND DEMONSTRATION EFFORTS

The results of previous and ongoing R&D studies on storm and combined sewer overflows have considerably advanced our understanding of the nature of the pollution problem, and produced methodology which can now be applied to full-scale abatement projects. At this time, it is more than possible to move into a program providing major stimulus to construction of storm and combined sewer overflow projects which will implement full system control.

R&D projects have demonstrated satisfactory or better than average performance utilizing several different control and treatment methods together with development of new techniques and hardware. A total list of completed R&D projects and those currently ongoing, is given in Table I.

Table I includes about 90 separate projects representing a most ambitious undertaking, but essential, for adequately combatting storm and combined sewer overflows across the country. It should nevertheless be cautioned that development of treatment techniques for combined sewer overflows has not in all cases been completely successful. Past treatment processes have been inherently designed to apply basically to steady-state flow conditions. Combined sewer overflows and storm runoff are on the extreme opposite side of steady-state conditions, occurring on an intermittent, random basis, with widely varying quality and quantity characteristics.

In general, techniques for storage or system control are considered more advanced than techniques for treating combined sewer overflows and storm discharges. Each method has been found to have its own advantages and limitations, and a workable abatement program for any given municipality will require attention of all, with incorporation of several selected methods and techniques, into the final plan of action and implementation. Table II gives a list of FWQA publications available for completed projects. The various approaches, techniques and methods which the Program considers are promising for short and long-range solutions and incorporated into Program grants and contracts are given as follows:

In-System monitoring and waste storage
Off-system storage and disinfection
Specialized waste disinfection systems
Improved flow regulation devices
Dissolved air flotation
Screening and microstraining

Flow measurement
Pressure or vacuum sewers
Modification of rainfall-runoff relationships
Waste flow reuse
Infiltration and sewer sealing
Construction materials and methods

Street cleaning procedures and role in runoff pollution
Polymers for improved waste solids settling
Polymers for increasing pipe flow carrying capacity
Sewer flushing procedures
Monitoring characteristics of waste flows
External and internal system modelling

Erosion and sediment control
Biological waste treatment systems
Inertial separation
High-rate filtration systems
Physical-chemical waste treatment systems

RESEARCH NEEDS

Priority research needs existing in the Storm and Combined Sewer Pollution Control Program which must be satisfied by strong extramural and in-house research, are focused upon the following subareas:

1. Modification and application of previously-developed techniques and methods
2. Continued evaluation of research results, refinement of development and performance criteria, application, cost effectiveness, etc.
3. Characterization of storm and combined sewer overflows and delineation of short and long-range effects on receiving water resources
4. Modification and application of instrumentation for flow measurement, in-system sensing and quality monitoring
5. Total system design and implementation
6. Further adaption of physical and chemical treatment processes for excess storm and combined sewer flows
7. Possibilities of more fully utilizing and improving physical characteristics of existing sewer systems
8. Reuse of combined sewer overflows and storm water discharges
9. Rainfall-runoff relationships, refinement of prediction criteria, and application to urban areas
10. Sediment-erosion control and quantification of damage
11. Adequate understanding, criteria, and control technology for minimizing pollution from unsewered storm runoff

EDISON, NEW JERSEY WATER QUALITY LABORATORY

The National R&D Program in Storm and Combined Sewer Pollution Control was officially started at Edison, New Jersey in January 1970. However, in November 1969, both the Branch personnel out of Headquarters and the Edison staff jointly collaborated in conducting the First Seminar on Storm and Combined Sewer Problems, held at the Edison Water Quality Laboratory. This seminar was extremely well received, with more than 130 persons in attendance, representing Federal, State, County and local government, interstate authorities, consulting engineering firms, universities, and other interests. Papers were presented on the nature of combined sewer problems; microstraining and disinfection; Program overview; storage of combined sewer overflows; simulation modelling of storm and combined sewer systems; screening and dissolved air flotation; and alternative treatment and control methods. Subsequently a second Symposium on Storm and Combined Sewer Overflows was held in June 1970 in Chicago, Illinois focusing on Program progress and problems Nationwide and in the Great Lakes States.

PROJECT MONITORING, FIELD PROGRAM SUPPORT

Personnel at the Edison Water Quality Laboratory are serving as project officers on nine FWQA grants and contracts ongoing or soon to be initiated. Another six FWQA grants and contracts in this Program area are currently being monitored by personnel of the Northeast Region in Boston. Over the past few months, the Edison Storm and Combined Sewer Overflow Section has provided strong technical support to Headquarters in many areas particularly on review of proposals, initiation of new grants and contracts, RFP preparation, and Work Plan development. This Section has also completed review of the 50 State Water Quality Standards and Implementation Plans to determine current perspective of the States on necessary abatement action for storm and combined sewer overflows.

STATE-OF-THE-ART ON HIGHWAY SALTING AND EFFECTS UPON THE ENVIRONMENT

A first draft report has been recently completed on highway deicing practices across the country and the real and potential pollutional consequences of using deicing compounds. Annual use of chemical deicing agents approximates 8 million tons of sodium chloride and 0.4 million tons of calcium chloride mostly used over 33 States. Remarkably high concentrations of salt ions are found in roadside drainage, runoff from streets and highways and within certain groundwaters, farm ponds, lakes, small streams, and various soils, vegetation and trees near highways. Severe effects and significant damage have been documented with respect to highway structures, groundwater supplies, and roadside vegetation and trees. Extensive damage is suspected in other areas. More than 122 references were used in compiling this report.

STATE-OF-THE-ART ON STATUS OF INSTRUMENTATION FOR FLOW MEASUREMENT, QUALITY MONITORING, AND SAMPLING

A second state-of-the-art was recently started by Edison, N. J. which is intended to give an in-depth assessment of conventional, improved and/or new devices for quantity and quality measurement of storm and combined sewer overflows. It is estimated this assignment is about 25 percent complete as of the end of September 1970. The major emphasis will be on flow measuring instrumentation capable of high level performance under adverse conditions of storm and combined sewer flows. Procedures for automatic monitoring and sampling of storm discharges will also be considered.

CHARACTERIZATION OF STORM RUNOFF AND COMBINED SEWER OVERFLOWS

Storm water runoff and combined sewer overflows are extremely variable and difficult to define in terms of pollution load - what, where and when. Certain studies have been conducted on the character of these flows but

the resulting data has been generally sparse and limited to unique site conditions. Most importantly, this type of data requires interrelating and critical evaluation. The Edison facility has initiated collection of information from the general literature, suspected sources of unpublished data, and findings of ongoing FWQA R&D projects. A good delineation of the character of storm and combined sewer overflows is required for planning control systems having an assured high level of performance. Since this picture is more fragmentory for storm runoff, initial emphasis will be placed on sewered and non-sewered storm discharges.

OTHER EDISON, NEW JERSEY ACTIVITIES - FY 71

Because of past involvement in preparing state-of-the-art reports, the Edison, New Jersey facility has compiled an extensive series of past reprints, publications, reports, etc. on the problems, nature and magnitude of storm and combined sewer discharges. Since this information should be of high value to the Program, documentation efforts in this regard will be continued.

The Storm and Combined Sewer Overflow R&D Section at Edison, New Jersey in addition to the above activities intends to undertake the following assignments:

1. Determine effects of combined sewer overflows on receiving water quality and setting water quality standards
2. Continued field support to Headquarters
3. Investigate various treatment processes and determine efficiency and limits
4. Establish an urban experimental watershed
5. Plans for ultimately establishing a field test site.

TABLE I

STORM AND COMBINED SEWER DEMONSTRATION PROJECT INFORMATION

September, 1970

A. Active Projects

B. Completed Projects

TABLE I-A

ACTIVE PROJECTS

ACTIVE PROJECT INFORMATION

Combined Sewer Overflows - 1102

Grants

Grantee	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
City of Akron, Akron, Ohio	"Demonstration of Void Space Storage with Treatment and Flow Regulation" 11022 DXH	The facility to be constructed and evaluated will include an excavated hopper shaped cavity, lined with a permeable membrane, filled with inert material covered with soil and the surface made useable. Storage will be in the void space of the fill. The influent will be regulated by a new and improved device, possibly a fluidic regulator. Combined sewer overflows will be pre-treated prior to entry.	George Harlow May 23, 1972
Board of County Commissioners, Montgomery County, Ohio	"The Determination of Ground Water Infiltration and the Effects of Internal Chemical Sealing of Sanitary Sewers" 11022 DHQ (WPRD 211-01-68)	This project will identify the cause and degree of surface and ground water infiltration and utilize new techniques for internal sewer sealing. An evaluation will be made to establish the most effective techniques and materials for sealing.	Eugene Harris September 30, 1971
New York State Dept. of Health Albany, N. Y.	"A Pressure Sewer System Demonstration" 11022 DQI	This project will demonstrate and evaluate a pressure sewer system which could be utilized for sewage separation. Prototype pump-grinder units developed by General Electric Company as part of ASCE contract (14-12-29) will be used to convey sewage from the home to the pressure sewer in the street.	Richard Keppler December, 1970

Grantee	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
City of Dallas, Dallas, Texas	"Stormwater Treatment Facilities" 11023 FAW (WPRD 35-TEX-1) (revised)	Treatment facility includes: flocculation and sedimentation basins; chemical feeds; and a waste lime sludge line from the municipal water treatment plant to the overflow treatment facility to treat overflows from sewers carrying a mixture of domestic wastewater and infiltrated stormwater. Among the treatment methods tried will be polishing with tube-type clarifiers and high-rate sedimentation. Effluents will be chlorinated. The facility will be evaluated for one year following completion of construction.	George Putnicki October, 1972
Metropolitan District Commission, Boston, Massachusetts	"The Summerville Marginal Conduit Including Pretreatment Facilities" 11023 DME	This project will evaluate screening and chlorination for treating combined sewer overflows. The screening will be as developed by Rex Chainbelt (14-12-40) and the chlorination as developed by Ionics (14-12-490); i.e., improved utilization of hi-current density electrolytic generation of sodium hypochlorite.	William Butler May 31, 1973
City of Rohnert Park, Calif.	"Treatment of Peak Wet Weather Wastewater Flows, and Rate Control of All Wastewater Discharges" 11023 DSX	A combined sedimentation and equalization pond will be constructed to include a unique sludge collection system for use as an aerator during dry weather. Excess flows from the pond will be delivered to a storage and chlorination pond (existing oxidation pond) and released after a two day detention and chlorination.	William Bishop January 10, 1972

Grantee	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
City of Detroit, Board of Water Commissioners, Detroit, Mich.	"System Monitoring and Remote Control" 11022 FAX (4-MICH-1)	Project consists of installation of power operated diversion structures and automatic control instrumentation. Telemetering will transmit data collected by flow and rainfall measuring instruments to relate status of drainage area and sewerage system for automatic control. This system will maximize the use of storage within the existing sewer system and thereby reduce pollution from combined sewer overflows. An evaluation of the system's effectiveness will be made.	Lawrence O'Leary June, 1971
City of Milwaukee, Milwaukee, Wis.	"Humbolt Ave. Overflow Detention and Chlorination Facility" 11023 FAU (10-WISC-1)	Project will demonstrate effectiveness of a detention tank and chlorination facilities for the treatment of combined sewer overflows. The tank influent will be screened. Design of tank is based on a 15 minute detention time for sedimentation and chlorination. After overflows, the sludge deposits and wastewater will be pumped back to the existing treatment plant. Aside from typical testing, the evaluation will include river monitoring.	Clifford Risley July, 1971
Sewerage and Water Board of New Orleans, New Orleans, Louisiana	"Chlorination and Hypochlorination of Polluted Storm Water Pumpage" 11023 FAS (14-LA-1)	The project will demonstrate effectiveness and economics of using open drainage canals and the use of chlorine and hypochlorite for control of bacteriological pollution. A fully automated sodium hypochlorite blending plant will be used.	George Putnicki August, 1971

Grantee	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
City of New York, Dept. of Water Resources, N.Y.	"Evaluation of Spring Creek Auxiliary Pollution Control Project" 11023 FAO (36-NY-2)	New York City is constructing a combined sewer overflow treatment facility to provide sedimentation and chlorination. This project will establish pre-construction water quality controls in Jamaica Bay and characteristics of parameters to measure effects of combined sewer overflows. A post-construction evaluation of the effectiveness of the combined sewer overflow treatment facilities will be made. It is anticipated that this facility will serve as a prototype for additional projects in New York City.	George Pence June, 1972
City of Chicago, Dept. of Public Works, Chicago, Illinois	"The Lawrence Ave. Underflow Sewer System" 11022 EMD (31-ILL-6)	The project is to evaluate the effectiveness of a deep tunnel system to temporarily store excess combined sewer overflows for subsequent return to sewage treatment plant. This will reduce discharge of untreated combined sewer overflows and minimize sewage treatment plant overloading. A feasibility study will enable Chicago to evaluate this method for use in its entire metropolitan area.	Clifford Risley. November, 1971
City of Dallas, Dallas, Texas	"Use of Polymers to Reduce or Eliminate Sewer Overflow in the Bachman Creek Sewer" 11022 DZU	The project includes construction and evaluation of a permanent polymer injection station for introduction of polymers into a sewer for the purpose of increasing carrying capacity. Evaluation will include design criteria, operating techniques and optimum polymer concentration.	George Putnicki June 23, 1971

Grantee	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
University of Cincinnati, Cincinnati, Ohio	"Urban Runoff Characteristics" 11024 DQU	The intent is to collect detailed information defining the physical characteristics of an urban drainage area and data relating to the quantity and quality of various sources of pollution within the combined sewer drainage area. The evaluation will provide insight regarding methods for controlling the strength and volume of overflows. The detailed data will be used for verification and utilization of FWQA's Storm Water Management Model.	Robert Feder August 31, 1972
City and County of San Francisco Public Works Department, San Francisco, California	"Treatment of Combined Sewer Overflows by the Dissolved Air Flotation Process" 11023 DXC (WPRD 258-01)	The project consists of construction of a combined sewer overflow treatment facility containing trash racks, short-term sedimentation for settleable solids removal, dissolved air flotation and chlorination. Pre-construction receiving water quality will be investigated so that a cost/effectiveness of treatment can be evaluated.	Robert Rock October, 1971
Metropolitan District Commission, Boston, Massachusetts	"Boston Univ. Bridge Storm Water Detention and Chlorination Station" 11023 FAT (7-MASS-1)	A detention basin will be constructed to capture peak flows and to chlorinate waste water to reduce combined sewer overflows into Charles River. The chlorinated effluent will flow by gravity into the Charles River and the sludge deposits in the detention tanks will be returned to the sewer system to be treated at the sewage treatment plant. Evaluation of the facility is included.	Allyn Richardson May, 1972

Grantee	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
Tulane University New Orleans, La.	"Bedding and Infiltration Studies of Sanitary Sewers in the Gulf Coast Area" 11022 DEI	Objectives are to determine optimum bedding materials and arrangements for laying sewer lines in the Gulf Coast Area. A "Manual" will result from study.	George Putnicki February 14, 1971
City of Cleveland, Cleveland, Ohio	"A Program for Demonstrating Combined Sewer Overflows Control Techniques for Water Quality Improvement and Beach Protection" 11023 EZW (WPRD 234-01-68)	Control and treatment measures to be applied include: (1) hypochlorination of overflows and streams; (2) use of polymers to reduce overflows; (3) sewer flushing to reduce solids in overflows; (4) screening of overflows and streams; (5) protective barriers to enclose beach areas; (6) water quality control within enclosed beach areas; (7) collection of debris and coarse solids; and (8) miscellaneous improvements.	George Harlow January, 1972
City of Mt. Clemens, Mt. Clemens, Mich.	"A Combined Sewerage Collection and Treatment Facility" 11023 FAR (37-MICH-2)	The project will demonstrate the feasibility of controlling combined sewer overflows by constructing three aerated "lakelets" which will be equipped with surface aeration and operated in series. "Lakelet" effluents will be subjected to chemical treatment, microstraining and chlorination prior to discharge to the Clinton River. The project will also explore these "lakelets" for use as recreation facilities.	Lawrence O'Leary October, 1971
Lehigh Univ. Bethlehem, Pennsylvania	"Transport of Solid Suspension in Conduits" 11024 EKD	The objectives are: (1) determination of criteria for minimum transport velocities of non-depositing solid-liquid mixtures in pipes; (2) development of a modified Venturi meter to measure flow rate and concentrations simultaneously.	Richard Dewling June 30, 1972

Grantee	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
City of Chippewa Falls, Wisconsin	"Utilization of a Storage Pond with Treatment for Combined Sewer Overflows" 11023 FIY (22-WISC-2)	Project will demonstrate the control and elimination of combined sewer overflows by diverting to a storage pond for sedimentation with subsequent discharge to the wastewater treatment plant. Project also includes construction for increased interceptor pumping capacity, final settling tank capacity, combined relief sewer and some separation. Evaluation will include: design, operation, efficiency, and comparision with separation.	Louis Breimhurst January, 1971
East Chicago Sanitary District, East Chicago, Indiana	"East Chicago Treatment Lagoon" 11023 FAV (11-IND-1)	Project will evaluate the effectiveness of treating combined sewer overflows in a very deep detention basin having aerobic and anaerobic treatment. The aerobic conditions are accomplished by surface aerators. The prime objective is to demonstrate a control method to optimize treatment of combined sewer overflows mixed with industrial wastewater.	Clifford Risley March, 1972
Municipality of Metropolitan Seattle, Seattle, Washington	"Dunwamish River--Elliot Bay Storm Water Control System" 11022 ELK (13-WASH-1)	A sewerage system control scheme designed to regulate and program flows through the use of regulator operation programmed by computers. System will contain selective controlled discharging of combined sewer overflows in a manner which will minimize effects on receiving waters by the utilization of automatic water quality monitors as control devices.	William Clothier June, 1973

Grantee	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
Boro of New Providence, New Jersey	"Utilization of High Rate Trickling Filters for Treatment of Combined Sewer Overflows" 11023 FAN (34-NJ-1)	High-rate trickling filters will be installed to treat a wide range of overflow volumes. This conventional treatment will be demonstrated on the adverse operating conditions caused by combined sewage. The project will include: surge tank; plastic and a stone filter medium; polyelectrolytes and other chemicals to improve sedimentation; and chlorination facilities. Evaluation will be on operation and effectiveness.	Albert Bromberg October, 1971
City of Sommersworth, New Hampshire	"Sommersworth, Sewage Overflow Treatment Project" 11023 FAP (30-NH-1)	The project includes construction and evaluation of combined sewer overflow storage tanks. The facilities will accomplish: (a) short-term detention, chlorination, and pumpback to the sewerage system; (b) variable sedimentation times, chlorination, long-term detention and discharge to the receiving stream. Effects of treatment on the receiving stream and sewage treatment plant will be evaluated. Polymers to increase interceptor carrying capacity will be explored.	Edmund Struzeski December, 1971
City of Kenosha, Kenosha, Wis.	"Demonstration Project of Biological Adsorption of Pollutants from Combined Storm Water Runoff and Sanitary Sewage" 11023 EKC	The project objective is to provide high-rate biological (activated sludge) treatment, clarification and disinfection of excess combined sewer overflows. The sludge will be stored in a reservoir and introduced to the contact tank proportionally with the combined sewer overflow for a 15-30 minute contact time. The effluent solids will be returned to a stabilization tank for reuse or waste.	Clifford Risley June 10, 1972

Grantee	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
City of Shelbyville, Illinois	"Systems Approach to Combined Sewer Stormwater Overflow Pollution Abatement" 11023 FAM (24-ILL-4)	This project will demonstrate a systems approach to combined sewer overflow pollution abatement. Three types of treatment will be evaluated as follows: (1) a storm overflow lagoon (5 day detention, 10 year storm), followed by primary and secondary stabilization lagoons, will receive flow from 95% of the drainage area; (2) a storm overflow lagoon designed for 600% of dry weather flow; (3) a primary storm holding tank for 600% of dry weather flow (2 hour detention) with chlorination, comminutor solids collecting facility and a sludge pump for return to treatment plant. These units will be coordinated into total control system for the community.	Ralph Christensen December, 1971
City of Racine, Wisconsin	"Demonstration of Screening/ Dissolved Air Flotation Treatment as an Alternate to Combined Sewer Separation" 11023 FWS	This project includes interception of several outfalls in Racine and directing flows to five screening/dissolved-air flotation treatment units, of which three will treat combined sewage, one storm water only, and one will treat both. There will also be verification of a combined sewer/water quality mathematical model.	Clifford Risley August 24, 1974
City of Richmond, Virginia	"Stream Pollution Abatement by Supplemental Pumping" 11022 FLV	This project will demonstrate the application of supplemental pumping, incorporating a special diversion device to avoid sewage bypassing during construction.	H. B. Thacker January 28, 1970

ACTIVE PROJECT INFORMATION

Combined Sewer Overflows - 1102

Contracts

Contractor	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
Southwest Research Institute, San Antonio, Texas	"Impregnation of Concrete Pipe" 14-12-835 11024 EQE	The project will investigate additives and coatings for concrete used for large diameter sewers for their ability to decrease permeability and increase resistance to chemical and bacterial attack while maintaining or improving physical and mechanical properties.	George Putnicki June 10, 1970
Ionics, Inc., Watertown, Massachusetts	"Feasibility of High Current Density Hypochlorite Generation" 14-12-490 11023 DAA	A one year study will determine the feasibility and economics of high current density hypochlorite generation for disinfection of storm and/or combined sewer overflows. If feasibility is determined, the design, fabrication and field testing of a full scale prototype device will follow.	Allyn Richardson December, 1970
The Franklin Institute - Research Laboratories, Philadelphia, Pennsylvania	"Continuous Survey of the Literature on Storm and Combined Sewers" 14-12-904 11024 FJE	A continuation of previous contract (14-12-467) which resulted in a compilation of abstracts summarizing technical papers on storm and combined sewer overflows.	Darwin Wright June 26, 1971

Contractor	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
American Public Works Association - Research Foundation, Chicago, Ill.	"Causes, Extent and Control of Infiltration" 14-12-550 11022 EFF	This project will be a study of the causes and control of storm and ground water infiltration into sanitary and combined sewers - including investigation of sewer design, construction testing, inspection and grouting practices. A final report and a "Manual of Recommended Practices" will be prepared.	Darwin Wright September 30, 1970
FMC Corporation, Santa Clara, California	"Evaluation of a Periodic Flushing System for Combined Sewer Cleaning" 14-12-466 11022 DNO	The project will demonstrate the feasibility of combined sewer overflow pollution abatement by means of periodic dry weather flushing. A theoretical basis correlating flushing requirements to sewer conditions and verification of hydraulic requirements for flushing by tests are included. Flushing water will be stored in flush tanks.	George Kirkpatrick January, 1971
Karl R. Rohrer Associates, Akron, Ohio	"Construction of a Facility to Demonstrate Offshore Underwater Temporary Storage of Storm Overflow from a Combined Sewer" 14-12-143 11022 ECV	A pilot plant underwater storage facility will be constructed and evaluated as a method of controlling combined sewer overflows. Storage will be in two 100,000 gallon flexible rubber nylon containers. The untreated wastes will be returned to the sewerage system for subsequent treatment.	George Kirkpatrick March, 1971

Contractor	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
Battelle Memorial Institute, Richland, Washington	"Development, Demonstration and Evaluation of Physical - Chemical Treatment of Combined Storm - Sanitary Sewage" 14-12-519 11023 DSQ	The basic physical - chemical process utilizing powdered activated carbon, inorganic coagulation, polyelectrolyte flocculation, sedimentation and carbon regeneration for treating combined sewer overflows will be demonstrated and evaluated. The process will begin with bench-scale experiments and carried through pilot-scale operations.	William Clothier December 23, 1972
Rex Chainbelt Inc., Technical Center, Milwaukee, Wis.	"Development and Demonstration of Combined Sewage Treatment Utilizing Screening, Chemical Oxidation and Split Flow Air Flotation" 14-12-40 11023 FDC	The project will fabricate and demonstrate a 5 mgd system for the treatment of combined sewer overflows using new techniques in chemical oxidation and high rate dissolved air flotation. The flotation unit will operate at 5 to 30% recycle rates of the total flow with 40 to 80 psig. This phase was completed July 31, 1970, and a final report is forthcoming. An investigative and demonstration phase on utilization of of sequential screening in conjunction with air flotation will be conducted. Screen sizes will progress from 1,840 to 60 microns.	Clifford Risley June 1, 1972

Contractor	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
Anatole J. Sipin Co., New York N. Y.	"Vibratory Sewer Flow Meter" 11024 FIU	This project proposes the development of a vibratory flowmeter for use in storm and combined sewers. The measurement principle is based on vribrating a sewer section at a constant frequency and amptitude in a direction transverse to flow, and sensing the dynamic reaction to provide a measure of mass flow rate. The advantages of this device would be that it provides an unobstructed passage for flow, it should not be affected by solids in the stream and that it should be capable of measuring true flow in both a partially filled or surcharged conduit.	Robert Dona July, 1971
Hydrospace Research Corp., Rockville, Md.	"Sewer Flow Measurement" 11024 EYD	This project proposes the development of a flow measuring device for sewage based upon the principles of hot-wire or hot-film anomometers. These devices have been successfully applied to mass flows of gases and liquids in laboratory and process-scale equipment. The device appears to be capable of overcoming the adversities of stormwater flow measurement.	H. R. Thacker August, 1972
Hittman Associates, Inc., Columbia, Md.	"A Portable Device for Measuring Wastewater Flow in Sewers" 11024 EYF	This project will develop a portable flow measuring device to overcome the adversities imposed by storm water discharges on conventional instrumentation. The instrument is based on the properties of electrical capacitance of a sewer cross-section with wastewater forming part of the dielectric and the volumetric flow rate measured directly by introducing a tracer (small air bubbles) immediately upstream from the measurement electrodes.	H. R. Thacker May, 1972

Contractor	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
Western Co. Research Division, Richardson Texas	"Evaluation of a New Pipe Joint System" 14-12-854 11023 FLY	This project will construct and evaluate a heat skrinkable sewer pipe jointing device. The goal is to develop the best over-all design and material for a flexible, leak proof, long lasting, easily installed and economically reasonable pipe joint. The performance reliability and economics will be compared to conventional joints.	George Putnicki May, 1971
Hydrotechnic Corporation, New York, N.Y.	"High Rate, Deep Bed, Multi-Media Filtration for Treating Combined Sewage" 14-12-858 11023 EYI	This project is investigating the feasibility of using screening and tri-media filtration in treatment of combined sewer overflows at the Cleveland Southerly Sewage Treatment Plant. The major objective is effective removal of suspended and settleable solids at filter rates of 20 gpm/sf or greater. Treatment of secondary effluents are also being studied.	Edmund Struzeski July, 1971
Hercules, Inc. Cumberland, Maryland	"Flocculation - Flotation Concept for Sewage Solids Separation" 14-12-855 11023 EYC	This project will develop and assess variables associated with flocculation as an aide to flotation, i.e., flocculant concentration vs. bouyant effect, sewage solids shock load effect, optimum scheme and permissible flow for treatment.	Frank Condon May, 1971

ACTIVE PROJECT INFORMATION

Storm Water Discharges - 1103

Grants

Grantee	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Da
City of La Salle, Illinois	"The Construction and Technical Evaluation of the Various Aspects of an Aluminum Storm Sewer System" 11032 DTI	This project is a demonstration of alleviating combined sewer overflow by the construction of a separate aluminum storm drainage system for a portion of the city. Evaluation will be made of the economics and performance of: Corrugated aluminum pipe; improved joint couplers, tapping saddles, catch basins, and manholes.	Clifford Risley. November 23, 1972
University of Illinois, Urbana, Illinois	"Development of the RRL Method of Storm Sewer Design" 11034 FLN	The project objective is to apply the British Road Research Laboratory (RRL) method for the design of storm sewers in 10 urban basins. The results of these applications would be used to evaluate the RRL method.	George Kirkpatrick June 24, 1972
City of South St. Paul, Minn.	"Demonstration Project for Temporary Detention of Storm and Combined Sewage in Natural Underground Formation" 11031 DSL (WPRD 249-01)	Natural permeable underground strata in the South St. Paul area will be used to demonstrate their capacity for the temporary storage of storm and combined sewer overflows. Prior to underground introduction, the wastewater will be treated for removal of SS, and chlorinated to eliminate possible contamination of potable water supply. The stored wastewater will subsequently be pumped out and transported to the sewage treatment plant.	Clarence Oster September, 1972

ACTIVE PROJECT INFORMATION

Storm Water Discharges - 1103

Contracts

Contractor	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
URS Research Co., Burlingame, Calif.	"Water Pollution Effects of Street Surface Contaminants" 11034 FUJ	The purpose of this project is to investigate and define the impacts of urban surface runoff and to develop alternate approaches to abating pollution from this source. Principal objectives are to: (1) determine state-of-the-art of street cleaning; (2) develop a means of assessing significant pollutants not usually captured by conventional sampling; (3) develop a standard procedure for assessing equipment and practice performance in terms of pollution control; and (4) define required improvements for street cleaning devices.	Frank Condon September 30, 1971
University of Minnesota, St. Anthony Falls Hydraulic Laboratory, Minneapolis, Minnesota	"Flow in Long Vertical Conduits with Reference to Design of Storm Water Drop Shafts" 14-12-861 11034 FLU	With the advent of "deep tunnel storage", problems in how to design vertical dropshafts to transport the sewage arose. Emphasis will be given to preventing cavitation, maximizing flows and economics. The intent is to investigate at a small-scale laboratory level and to provide design data for a prototype scale-model.	Clarence Oster August 5, 1971

ACTIVE PROJECT INFORMATION

Non-Sewered Runoff - 1104

Grants

Grantee	Project Title Project Number	Brief Project Description	Project Officer & Anticipated Completion Date
The Regents of the University of Michigan, Ann Arbor, Mich.	"Rainfall-Runoff Relations on Urban (and Rural) Areas" 11041 DRS (WP-00834-04)	The purpose is to derive a better understanding of factors which control the relationship between rainfall and runoff, and to determine the effect of urbanization in this regard. The benefits include improved design of storm drainage systems, and better design and operation of storm and combined sewer overflow pollution control facilities.	Robert Buckley May, 1972

TABLE I-B

COMPLETED PROJECTS

COMPLETED PROJECT INFORMATION

Combined Sewer Overflows - 1102

Grants

Grantee	Project Title Project Number	Brief Project Description	Project Officer
City of Columbus Columbus, Ohio	"Modification of Whittier Street Storm Standby Tanks" 11023 FAL (27-OHIO-1)	Existing combined sewer overflow tanks have been modernized by the installation of automatic sluice gates, sludge collectors and pumps. The objectives are: (1) to reduce sludge levels thereby preventing septic odors and decomposition and (2) to control flows at the treatment plant by use of sluice gates. Evaluation will be on the treatment units as well as the river. Final report is pending.	Robert Feder
Springfield Sanitary District, Springfield, Ill.	"Evaluation of a Stabilization Pond for Treatment of Combined Sewer Overflows" 3-ILL-1	A 12 acre stabilization pond received by-passed overflows to determine its effectiveness as a treatment device. Evaluation will include routine sampling of influent and effluent, and biological examination of the pond and receiving stream. Final report is pending.	Ralph Christensen
Metropolitan Sewer Board St. Paul, Minnesota	"Dispatching System for Control of Combined Sewer Losses" 11022 FAQ (1-MINN-1)	A supervisory system was provided to telemeter gate positions, flows and levels in sewers to be controlled by new regulators. The information is transmitted to a central receiving station where a dispatching operator can observe conditions and regulate flow accordingly. This would maximize use of the interceptor capacity and minimize overflows. Final report is pending.	Louis Breimhurst

Grantee	Project Title Project Number	Brief Project Description	Project Officer
Merrimack College, North Andover, Mass.	"Controlling Pollution from Combined Sewer Overflows and Storm Water by Electrode Potential" 11024 DOK (WPRD 217-01-68)	A laboratory feasibility investigation, utilizing an electrode potential measuring system, was made to indicate the strength of combined sewer overflows. This project will also study possibilities of incorporating the electrolytic curcuit into mechanical flow control schemes. Final report (11024 DOK 02/70) is available.	Warren Oldaker
City of New York Dept. of Water Resources, New York, N. Y.	"Wards Island Water Pollution Control Plant Ponsor Flow Regulator Siphon" 25-NY-1	A new regulating device was evaluated. The function of the device is to deliver a predetermined maximum volume of combined sewage to the interceptor with the objective of evening-out hydraulic load on the treatment plant for increasing operating efficiency and to decrease the possibility that, during high flows, inadequately treated sewage would "overflow" the plant. The regulator operates on a siphon principle where the flow is proportional to the sum of hydrostatic and differential pressure heads. An adjacent conventional regulator was to be monitored for comparison. The project was concluded after preparation of the pre-construction evaluation report.	Albert Bromberg
City of Meridian, Idaho	"Reduction of Ground Water Infiltration into Sewers by Zone Pumping" 29-IDA-2	The intent of this project was to field demonstrate the reduction of ground water infiltration into sanitary sewers by pumped draw-down of the water table. The water table was shown to be lowered and the flow to the treatment plant reduced. However, this method is not economical when compared to other alternatives for the area. The final report (DAST-9 11020 DIH 06/69) is available.	Richard Latimer

COMPLETED PROJECT INFORMATION

Combined Sewer Overflows - 1102

Contracts

Contractor	Project Title Project Number	Brief Project Description	Project Officer
American Public Works Association, Chicago, Illinois	"Analysis of Regulator Facilities, Their Application and Maintenance Practices" 14-12-456 11022 DMU	The study analyzed combined sewer regulator facilities to determine needed improvements for reducing pollution. The results contain design criteria, and operation and maintenance practices, stressing newly developed or improved materials and technology; and identify future R&D needs. Final reports (11022 DMU 07/70 and 11022 DMU 08/70) are available.	Darwin Wright
Black, Crow and Eidsness, Atlanta, Ga.	"An Engineering Investigation of Combined Sewer Problems of Atlanta, Ga." 14-12-458 11024 ELB	This detailed engineering investigation of the South River Drainage Basin of Atlanta evaluated the economics and feasibility of alternate storm and combined sewer overflow pollution abatement schemes. Including separation, storage and treatment; a correlation between pollution load and land-use was also accomplished. Final report is pending.	Asa Foster
Roy F. Weston, Environmental Science and Engineers, West Chester, Pa.	"Kingman Lake Recreational Area — Phase I Engineering Investigation" 14-12-829 11023 FIX	Study included an engineering investigation to develop design parameters, soils information and cost estimates necessary for the construction of a combined sewer overflow treatment facility for the Northeast Boundary Trunk Sewer drainage area, Washington, D.C. The overflows are intended for reuse in the Kingman Lake recreational area for boating, fishing and swimming. Final report is pending.	Darwin Wright

Contractor	Project Title Project Number	Brief Project Description	Project Officer
Melpar, Inc., Falls Church, Virginia	"Construction of a Facility to Demonstrate Underwater Temporary Storage of Storm Overflow from a Combined Sewer" 14-12-41	This project was the initial feasibility phase for a later contract (14-12-133) (11022 DPP) involving the prototype construction of an underwater facility for temporarily storing combined sewer overflows.	George Kirkpatrick
Underwater Storage, Inc., Washington, D. C.	"Demonstration Underwater Facility to Provide Temporary Storage of Storm Overflows from a Combined Sewer" 14-12-42	This project was the initial feasibility phase for a later contract (14-12-139) (11022 DWF) involving the prototype construction of an underwater facility for temporarily storing combined sewer overflows.	George Kirkpatrick
Karl R. Rohrer Associates, Akron, Ohio	"Construction of a Facility to Demonstrate Offshore Underwater Temporary Storage of Storm Overflow from a Combined Sewer" 14-12-25	This project was the initial feasibility phase for a later contract (14-12-143) (11022 ECV) involving the prototype construction of an underwater facility for temporarily storing combined sewer overflows.	George Kirkpatrick

Contractor	Project Title Project Number	Brief Project Description	Project Officer
Metcalf and Eddy, Inc., Engineers, Palo Alto, California	"Engineering Investigation of the East Bay Municipal Utility District of the San Francisco Bay Area (Oakland)" 14-12-407 11024 EQG	This study included an engineering investigation of infiltration problems in the East Bay Utility District. Excessive infiltration causes the existing sanitary sewerage system to function as a combined system during wet weather. Alternate engineering solutions were developed on the basis of cost/effectiveness. Final report is pending.	William Bishop
Water Resources Engineers, Inc., Walnut Creek, California 14-12-501 11024 EBI Metcalf and Eddy, Inc., Engineers, Palo Alto, California 14-12-502 11024 DOC University of Florida, Dept. of Environmental Engineering, Gainsville, Florida 14-12-503 11024 EBJ	"TRIUMVIRATE, Storm Water Management Model"	These three contractors have joined together to develop a comprehensive mathematical model capable of defining both quality and quantity runoff phenomena throughout the various stages of precipitation, collection, storage, treatment and points within the receiving streams of the basin. The model simulation ability was verified by field tests. This system is a much needed working tool for local governments in the management and control of stormwater pollution. The final report is pending.	Darwin Wright

Contractor	Project Title Project Number	Brief Prject Description	Project Officer
Allis Chalmers, Milwaukee, Wisconsin	"Design, Construction, Operation and Evaluation of a Demonstration Waste Treatment Device Termed the 'Rotating Biological Contactor'" 14-12-24	This project demonstrated the applicability of a "rotating biological contactor", a new concept of biological treatment for treating combined sewer overflows. The method uses power-driven rotating discs as the "housing media" for biological growths. Previous laboratory studies indicated detention times can be greatly shortened as compared to conventional methods. Therefore, this technique offers a potential for biological treatment of flows greater than dry weather magnitudes, an important factor in treating combined sewer overflows. Final report is pending.	Darwin Wright
Henningson, Durham, and Richardson, Omaha, Nebraska	"An Engineering Investigation of Storm and Combined Sewer Problems" 14-12-402 11024 FEJ	This study of storm and combined sewer overflows in Des Moines, Iowa included field investigation to pinpoint and assess existing problems and recommended alternate solutions based on cost/effectiveness. The solutions included surge or retention basins, percolation basins, clarification, and utilization of flood control facilities and existing channels. Estimates for sewer separation were also developed. Final report is pending.	Ralph Christensen

Contractor	Project Title Project Number	Brief Project Description	Project Officer
R. F. Weston, Environmental Science and Engineering Consultants, West Chester, Pennsylvania	"Develop and Demonstrate a Method for Assessing the Extent of Pollution from Storm Water Runoff in an Urban Area" 14-12-403 11024 EXF	This study investigated combined sewer overflow problems from a 25 square mile drainage area in the District of Columbia. Alternate corrective approaches were investigated with emphasis on chemical flocculation and high rate filtration. The "deep tunnel" storage concept was also considered. Laboratory research was conducted to determine the efficiency of removing solids and BOD by this process. Final report is pending.	H. R. Thacker
American Society of Civil Engineers, New York, New York	"Feasibility and Development of New Methods of Separating Sanitary Sewage from Combined Sewerage Systems" 14-12-29	This study was concerned with the separation of combined sewers. The method considered withdrawal of the sanitary fraction of sewage from existing plumbing systems and passing this portion thru a sequence of added systems as follows: (1) a storage, grinding and pumping unit in the building; (2) pressure tubing through the existing building sewer to the existing combined sewer; and (3) pressure piping inserted in the combined sewer to the existing interceptors. The feasibility of this process has been established. The final report (ORD-4 or 11020 EKO 10/69) is available.	George Kirkpatrick

Contractor	Project Title Project Number	Brief Project Description	Project Officer
American Public Works Association, Chicago, Illinois	"The Problems of Combined Sewer Facilities and Overflows in United States Communities" 14-12-65	This project was a study of the effects and means of correcting combined sewer overflows. The study involved a nationwide inventory to gather statistical data on: area and population served by combined sewers, overflow locations, type and number of regulators, associated land and water uses, sewer separation cost estimates (by States) and alternate control and/or treatment methods. The final report (WP-20-11 or 11020--- 12/67) has been received.	Darwin Wright
FMC Corporation, Santa Clara, California	"Demonstrate the Feasibility of Reducing Pollution from Combined Sewer Storm Overflows by Means of Periodic Flushing During Dry Weather" 14-12-19	This project studied the feasibility of periodic flushing as a means of reducing wet weather pollution. The study included flushing practices, application requirements, hydraulic theory and sampling methods and equipment. Flushing test equipment was designed for Phase II (14-12-466). It was concluded, based on existing information, that flushing would be beneficial. The final report (11022--- 8/67) has been received.	George Kirkpatrick

Contractor	Project Title Project Number	Brief Project Description	Project Officer
Fram Corp., East Providence, Rhode Island	"Feasibility Investigation of a Self-Cleaning Strainer and a Self-Cleaning Filter" 14-12-17	The objective was to evaluate the feasibility of a "self-cleaning strainer, self-cleaning filter for treatment of combined sewer overflows. It was shown that the strainer model produced consistent SS removals of about 35% under highly varying load conditions, at a flux of 25 gpm/sf. The final report (WP-20-16 or 11020 EXV 07/69) is available.	Frank Condon
The Franklin Institute - Research Laboratories, Philadelphia, Pennsylvania	"Selected Abstracts of Storm Water Discharges and Combined Sewer Overflows" 14-12-467	The purpose of this contract was to compile Selected Urban Storm Water Runoff Abstracts summarizing articles from a variety of technical publications. The final report (WP-20-21 or 11020 DES 06/69) is available.	Darwin Wright
Acoustica Associates, Inc., Los Angeles, California	"A Study of the Feasibility of Use of Ultrasonic Filtration in Treating the Overflows from Combined and/or Storm Sewers" 14-12-23	The project demonstrated the feasibility of ultrasonic filtration for treating storm and combined sewage on a laboratory scale. The technique employs permanent low-head filter elements mounted on canisters into which ultrasonic energy is applied. Three benefits were observed: (1) the total influent quantity filtered between backwash cycles increased by 4 to 18 times; (2) the length of filter runs between backwashing increased from 4 to 10 times; and (3) the ultrasonic energy restored filter elements to a "like new" condition. The final report (11023-[illegible]/69/67) has been received.	Darwin Wright

Contractor	Project Title Project Number	Brief Project Description	Project Officer
Hercules, Inc., Cumberland, Maryland	"Proposal for a Self-Adjusting and Self-Cleaning Filter Feasibility Study" 14-12-39	The feasibility of developing a self-cleaning, self-adjusting filtering device constructed of a cylindrical structure of fibers laid down in predetermined patterns by a winding process and bonded in place by resins, was investigated. The permeability of the structure is imparted by a mechanical cracking (crazing) of the resin. The tube would act as a normal pipe under open channel flow, whereas a 4 psig pressure would render the walls permeable. A 62% SS reduction was indicated. However, sustained runs could not be realized and the self-cleaning aspect was not shown. The final report (DAST-4 or 11020 --- 10/69) is available.	H. R. Thacker
The Western Co., Richardson, Texas	"Methods to Reduce Water Pollution Caused by Storm Water Sewer Loading by Using Fluid Flow Friction Reducers" 14-12-34	Six polymers were investigated to determine their effects on increasing pipe carrying capacity while observing toxicity and effects on sewage treatment. It was found that a maximum flow increase of 240% could be obtained at a constant head. Field tests on a 24-inch line demonstrated surcharges of greater than 6 feet could be eliminated by polymer additions. The polymers were non-toxic to the biota and did not act as a bio-stimulant for algae. The cost of using polymers during peak storm conditions was shown to be one-fifth of that for new construction. The final report (WP-20-22 or 11020 DIG 08/69) is available.	George Kirkpatrick

Contractor	Project Title Project Number	Brief Project Description	Project Officer
Havens and Emerson, Cleveland, Ohio	"Feasibility Study of a Stabilization-Retention Basin for the Treatment of Combined Sewer Overflows, Wastewater, Treatment Plant Effluents and Surface Runoff Waters at Cleveland, Ohio" 14-12-27	A feasibility study was conducted of a large stabilization-retention basin to be constructed in Lake Erie at Cleveland as an alternate to sewer separation. Treatment consists of bio-oxidation, sedimentation, stabilization and disinfection. It was concluded that the basin would provide a higher degree of pollution abatement than sewer separation at about one-third the cost. The final report (11023--- 05/68) has been received.	Robert Feder
Bowles Engineering Corp., Silver Spring, Maryland	"Fluidic Interceptor Study" 14-12-486 11020 DGZ	A Fluidic Regulator was developed to minimize combined sewer overflow while protecting interceptors from overloading. This device diverts combined sewer overflows into the interceptor as a function of interceptor or trunk sewer liquid levels. Installation costs are anticipated to be only slightly more than for conventional types. However, the operation and maintenance of the Fluidic Regulator, having no mechanical parts, will be simple and minimal, which should reflect lower total costs. The final report (DAST-13 or 11020 DGZ 10/69) is available.	Darwin Wright
The Western Co., Richardson, Texas	"Materials to Reduce or Eliminate Infiltration into Sewerage Systems" 14-12-146	This program developed new, more effective sealants for sewer line leaks. The wide range of equipment and materials tested or compared are presented in the final report along with test results, supporting data, conclusions and recommendations. Long-term field tests were recommended. The final report (WP-20-18 or 11020 DIH 06/69) is available.	George Putnicki

Contractor	Project Title Project Number	Brief Project Description	Project Officer
Aerojet - General, Corp., El Monte, California	"Role of Solids in Combined Sewage Pollution" 14-12-180	The purpose was to evaluate the feasibility and potential benefits obtained by solids removal by in-sewer screening devices. The effect on chlorination requirements resulting from solids removals was also investigated. An evaluation was made between aesthetic water quality considerations and proposed state water quality standards for water bodies receiving combined overflows. The final report is pending.	John Merrell
Aerojet - General, Corp., El Monte, California	"A Method for Assessing the Extent of Pollution from Stormwater Runoff from an Urban Area" 14-12-197	This study investigated combined sewer overflow problems in Sacramento, California. Potential control and/or treatment systems, including high-rate cyclone and air flotation, combustible filter, pressure sewers, temporary storage, deep tunnel storage, stabilization ponds and sewer separation were evaluated for applicability. Final report is pending.	John Merrell
Hayes, Seay, Mattern & Mattern, Roanoke, Virginia	"Engineering Investigation of Combined Sewer Overflow Problems" 14-12-200 11024 DMS	This study investigated overloaded sewer problems in Roanoke caused by stormwater entering the sanitary sewerage system. Preliminary plans for remedial measures, based on cost/effectiveness, were prepared. Final report is pending.	H. R. Thacker

Contractor	Project Title Project Number	Brief Project Description	Project Officer
Rand Development Corp., Cleveland, Ohio	"Rapid Flow Combustible Filter" WA 67-2 11023 DPI	This project included construction and evaluation of rapid flow combustible filter for treating combined sewer overflows. The filter media used for mechanical filtration of coarse solids was primarily coal. The process incinerates the filter media upon exhaustion. The project evaluation rendered this method unfeasible. Final report (11023 DPI 08/69) is available.	Robert Feder
Rhodes Corp., Oklahoma City, Oklahoma	"Use of a New Technique for Waste Treatment" 14-12-11 11024 FKI	The project included construction and evaluation of cyclones for coarse solids removal followed by high-rate dissolved air flotation for removal of finer solids. Flotation unit detention times were less than 10 minutes. The demonstration was on a ½ MGD prototype unit. Both wet and dry weather flow were treated. Discrete data for storm events were kept. Final report (11020 FKI 01/70) is available.	George Putnicki
Dow Chemical Co., Midland, Mich.	"Demonstration and Evaluation of Polymeric Additives in the Treatment of Stormwater Overflow" 14-12-9 11023 FDB	Flocculant studies were carried out on both laboratory and full-scale to demonstrate the effect of polymeric flocculants including the effectiveness of disinfectants with and without polymer addition. The installation studied was a 3.5 MG detention basin serving an area of about 3,700 acres. A part of this project was the fabrication of the existing basin model. This model was concurrently tested with the full-scale basin to validate and optimize its use for model extrapolation. Final report is pending.	Ralph Christensen

Contractor	Project Title Project Number	Brief Project Description	Project Officer
Cornell, Howland, Hayes and Merryfield, Engineers and Planners, Corvallis, Ore.	"Primary Treatment of Storm Water Overflow from Combined Sewers by High Rate Fine Mesh Screens" 14-12-121 11023 FDD	This project included the construction and evaluation of a primary treatment device containing high rate, fine mesh vibrating screens for combined sewer overflow solids removal. Final report (11023 FDD 03/70) is available.	William Clothier
Underwater Storage, Inc., Washington, D.C.	"Pilot Demonstration Underwater Storage Facility for Storm Water Overflow" 14-12-139 11022 DWF	The project included construction and evaluation of a pilot plant underwater facility for temporary storage of combined sewer overflows. The facility consists of two 100,000 gallon flexible rubber nylon containers anchored to the river bed. Following overflows, the stored wastewater will be pumped back to the sewerage system. Final report (11020 DWF 12/69) is available.	George Kirkpatrick
Melpar Inc., Falls Church, Virginia	"Pilot Plant for Underwater Storage of Combined Sewer Overflows" 14-12-133 11022 DPP	The project included construction and evaluation of a pilot plant underwater facility for temporary storage of combined sewer overflows. The facility consists of a single 200,000 gallon container, the bottom of which was of vinyl coated steel placed in an excavated depression in the river bottom. The upper half was of flexible neoprene coated nylon. Following overflows, the stored sewage was pumped back to the sewerage system. Final report is pending.	George Kirkpatrick

Contractor	Project Title Project Number	Brief Project Description	Project Officer
Cochrane Division, Crane Company, King of Prussia, Pennsylvania	"Microstraining, Ozonization and Chlorination Pilot Tests on Combined Sewer Overflows" 14-12-136 11023 EVO	The project involved construction and evaluation of microstrainers and ozone used for disinfecting combined sewer overflows. Final report (11023 EVO 06/70) is available.	Allyn Richardson
American Process Equipment Corp., Panama City, Florida	"Fabrication and Evaluation of an Ultrasonic Filtration System for Treating Combined Sewer Overflows" 14-12-195 11023 DZF	The project fabricated and demonstrated a prototype ultrasonic filtration system (maximum capacity 160 gpm). 65% BOD and SS removals for a 50 micron element treating raw sewage (degrited) has been previously demonstrated in the laboratory. Ultrasonic energy can restore filter elements to "like new" condition without frequent element replacements. Pretreatment requirements were determined and automatic operating procedures established. The final report is pending.	Darwin Wright
Burgess and Niple Ltd., Consulting Engineers, Columbus, Ohio	"Engineering Investigation of Storm and Combined Sewer Pollution Bucyrus, Ohio" 14-12-401 11024 FKN	This study investigated combined sewer problems and evaluated the benefits, economics and feasibility of collection and treatment of combined sewer overflows in Bucyrus. Corrective plans considered storage concepts, physical and chemical treatment, partial sewer separation and possible sewage treatment plant modifications. The final report (11024 FKN 11/69) is available.	Alfred Smith

Contractor	Project Title Project Number	Brief Project Description	Project Officer
American Standard, Inc., New Brunswick, N. J.	"Develop a Suspended Solids Monitor" 14-12-494 11024 DZB	This project developed and evaluated an instantaneous SS monitor for use in continuously measuring SS in sewage. The technique employed is based on the measurement of light depolarization. Field calabration of prototype was conducted. Final report is pending.	Allyn Richardson

COMPLETED PROJECT INFORMATION

Storm Water Discharges - 1103

Contracts

Contractor	Project Title Project Number	Brief Project Description	Project Officer
Hittman Associates, Inc. Baltimore, Md.	"System Study Design and Evaluation of Local Storage, Treatment and Reuse of Storm Water" 14-12-20 11030 DNK	The project investigated the feasibility of collecting runoff, and storing, treating and reusing this runoff as an alternate means to water supply augmentation and more costly treatment. The study covered hydrological events, public acceptance and legal aspects of reuse, designs of "conventional" and demonstration systems, detailed cost estimates of the demonstration system, and development of stormwater treatment systems for potable and sub-potable water uses. The final report (11031 --- 08/68) is available.	George Kirkpatrick
AVCO-Economics System Corp. Washington, D.C.	"Develop the Relation between Land-Use Practices and Influence of Pollution in Urban Storm Water" 14-12-187	This study attempted to develop relationships between land-use practices and degree of pollution in urban stormwater runoff in Tulsa, Okla. Also included was a recommended program for corrective measures emphasizing regulatory controls of the drainage area such as improved urban planning and land-use provisions. Final report is pending.	George Putnicki

Contractor	Project Title Project Number	Brief Project Description	Project Officer
American Public Works Association, Chicago, Illinois	"Study of Methods for Reducing Water Pollution from Storm Sewer and Combination Discharges through Defined Public Works Practices" 11030 DNS WA 66-23	This study was conducted to determine environmental factors which contribute to the adverse effects of urban stormwater runoff and to determine methods to limit this source of water pollution. Street debris was found to be a significant factor. Street cleaning methods and equipment were evaluated. Catch basins containing large quantities of septic liquid were also determined to be a potential source of pollution. Other potential sources considered were air pollution, roof discharges, and chemicals applied to the urban surfaces. Final report (WP 20-15 or 11030 DNS 01/69) is available.	Darwin Wright

COMPLETED PROJECT INFORMATION

Non-Sewered Runoff - 1104

Contracts

Contractor	Project Title Project Number	Brief Project Description	Project Officer
Dow Chemical Company, Midland, Michigan	"Rock Creek Clarification Project" 14-12-170	This project studied the feasibility of providing in-stream treatment to the upper portion of Rock Creek with polymer addition followed by a settling basin controlled by a collapsible fabridam and sludge removal system. The project was determined to be unfeasible due to high costs and limited benefits. The final report has been received.	Patrick Tobin

COMPLETED PROJECT INFORMATION

Municipal and Industrial Waste Treatment - 1213

Grants

Grantee	Project Title Project Number	Brief Project Description	Project Officer
City of South St. Paul, Minn.	"Efficiency and Economy of Polymeric Sewage Clarification" 12130 EKK (WPRD 111-01)	This was a feasibility demonstration of polymer use for three types of sewage as follows: (1) industrial only; (2) combined storm and sanitary; and (3) sanitary only. Various types, combinations of types and varying concentrations of polymers were added to an existing municipal settling unit and evaluated. Although this project is in the PPBS 1213 series, the Storm and Combined Sewer Pollution Control R&D Program has a prime interest in demonstrating the use of polymers for combined sewage sedimentation. The final report is pending.	George Keeler

COMPLETED PROJECT INFORMATION

Control of Pollution from Construction - 1503

Grants

Grantee	Project Title Project Number	Brief Project Description	Project Officer
National Association of Counties - Research Foundation, Washington, D. C.	"Community Action Guide for Erosion and Sedimentation Control" 15030 DTL	A "Community Action Guide for Erosion and Sedimentation Control" to provide information on planning operations and management was developed along with a preliminary State-of-the-Art Report. Specific R&D needs were defined. The final report (15030 DTL 03/70) is available.	Darwin Wright

TABLE II

FWQA Reports Available for Completed Grants and Contracts
Studies on Storm and Combined Sewer Discharges

Many R&D reports dealing with various aspects of evaluation, treatment and control of storm and combined sewer flows have been completed under partial or total direction of the Storm and Combined Sewer Pollution Control Branch, aided by the Edison Laboratory. Various other reports are in final draft stage and information will be forthcoming when these reports are available. Except for publications out of print or those available only from the U. S. Government Printing Office (as indicated below), requests for copies of reports should be made to: Project Reports, Planning and Resources Office, Office of Research and Development, Federal Water Quality Administration, Washington, D. C. 20242.

TABLE II

FWQA Reports Available for Completed Grants and Contracts - Studies on Storm and Combined Sewer Discharges

Report Number Publication Date	Title
	Series of Reports from ASCE Project on Sewer Separation Using Pressure Conduits (Contract 14-12-29) (11020 EKO)
11020 EKO 08/67	Relationship of Sewage Characteristics to Carrying Velocity for Pressure Sewers
11020 EKO 12/67	Combined Sewer Separation Project Report to ASCE
1102C EKO 04/68	Turbulent Friction in Eccentric Annular Conduits
11020 EKO 04/68	Long-Term Operation of Wastewater Observation Stations
11020 EKO 06/68	Special Requirements for a Full-Scale Demonstration of the ASCE Combined Sewer Separation Project Scheme
11020 EKO 09/68	Pressure Sewerage System, Summer Street Separation Study Area, Boston, Massachusetts, Report
11020 EKO 12/68	Advanced Development of Household Pump-Storage Grinder Unit
11020 EKO 12/68	Develop and Field Test Method of Installing Pressure Conduits in Combined Sewers
11020 EKO 10/69	Combined Sewer Separation Using Pressure Sewers (Final Project Report) (ORD-4)
	Other Program Reports
11022 --- 08/67	*Phase I - Feasibility of a Periodic Flushing System for Combined Sewer Cleaning
11023 --- 09/67	*Demonstrate Feasibility of the Use of Ultrasonic Filtration in Treating the Overflows from Combined and/or Storm Sewers

*Out of print

Report Number Publication Date	Title
11020 --- 12/67	**Problems of Combined Sewer Facilities and Overflows - 1967 (WP-20-11)
11023 --- 05/68	*Feasibility of a Stabilization - Retention Basin in Lake Erie at Cleveland, Ohio
11031 --- 08/68	*The Beneficial Use of Storm Water
11023 DPI 08/69	*Rapid-Flow Filter for Sewer Overflows
11030 DNS 01/69	**Water Pollution Aspects of Urban Runoff (WP-20-15)
11020 DES 06/69	*Selected Urban Storm Water Runoff Abstracts (WP-20-21)
11020 --- 06/69	Sewer Infiltration Reduction by Zone Pumping (DAST-9)
11020 DIH 06/69	Improved Sealants for Infiltration Control (WP-20-18)
11020 EXV 07/69	Strainer/Filter Treatment of Combined Sewer Overflows (WP-20-16)
11020 DIG 08/69	Polymers for Sewer Flow Control (WP-20-22)
11020 DGZ 10/69	Design of a Combined Sewer Fluidic Regulator (DAST-13)
11020 --- 10/69	Crazed Resin Filtration of Combined Sewer Overflows (DAST-4)
11024 FKN 11/69	Storm Pollution and Abatement from Combined Sewer Overflows - Bucyrus, Ohio (DAST-32)
11020 DWF 12/69	Control of Pollution by Underwater Storage (DAST-29)
11000 --- 12/69	Storm and Combined Sewer Demonstration Projects - January 1970 (DAST-36)
11020 FKI 01/70	*Dissolved Air Flotation Treatment of Combined Sewer Overflows (WP-20-17)
11024 DOK 02/70	Proposed Combined Sewer Control by Electrode Potential
11023 FDD 03/70	Rotary Vibratory Fine Screening of Combined Sewer Overflows (DAST-5)
15030 DTL 03/70	Community Action Guidebook for Soil Erosion and Sediment Control
11024 DMS 05/70	Engineering Investigation of Sewer Overflow Problem - Roanoke, Virginia
11024 --- 06/70	Combined Sewer Overflow Abatement Technology
11023 EVO 06/70	Microstraining and Disinfection of Combined Sewer Overflows
11022 DMU 07/70	Combined Sewer Regulator Overflow Facilities
11034 FKL 07/70	Storm Water Pollution from Urban Land Activity

*Out of print
**U. S. Government Printing Office, Washington, D. C.

Report Number Publication Date	Title
11020 --- 08/70	Combined Sewer Overflow Seminar Papers
11022 DMU 08/70	Combined Sewer Regulation and Management - A Manual of Practice
CWT 10-11	***An Evaluation of the Significance of Combined Sewer Overflows in the Hudson River Conference Area

***Available from Edison Water Quality Laboratory